Central Puget Sound
Regional Fare Coordination System

Fixed WDOLS Installation Procedure - Pierce Transit

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1 Introduction

This document is an installation procedure that provides fixed Wireless Data On/Off Loading System (WDOLS) installation instructions for the three Access Points (APs) (two rooftop mounted, one server room mounted) that will be installed at Pierce Transit (PT) for the Beta phase of the Central Puget Sound Regional Fare Coordination System (RFCS) project. This document also contains installation instructions for the single fixed WDOLS that will be installed for Phase 2 of the project.

1.1 Purpose

The purpose of this document is to show how and where to install the fixed WDOLS that will provide wireless connectivity to the buses that will be part of Beta and Phase 2. It is intended to show clearly where the antenna mounting pole will be mounted, and by what means. It explains cable routing for the coaxial cable that connects the antenna to the Cisco 1242 AP and where and how to mount the AP. These details will be provided for all of the fixed WDOLS installations at PT.

1.2 Scope

This document describes installation details for the fixed WDOLS installations at the PT Main Base.

1.3 Terminology

This section contains a list of acronyms, abbreviations, and terms used in this document.

Table 1 contains the acronyms and abbreviations that are specific to ERG Transit Systems (USA), Inc. (ERG). In general, industry-standard acronyms and abbreviations are not defined in this table.

Table 1: Acronyms and Abbreviations

Acronym or Abbreviation	Definition
DAC	Data Acquisition Computer
ERG	ERG Transit Systems (USA), Inc.
PT	Pierce Transit
RFCS	Regional Fare Coordination System
WDOLS	Wireless Data On/Off Loading System

1.4 References

[1] Day Wireless Site Survey Report
ERG Site Survey Report Final.pdf

[2] SEA-03913 Fixed WDOLS Installation Requirements - Phase II

2 Beta Fixed WDOLS Installations

2.1 PT Main Base Installation Instructions

Based on the site survey conducted by Day Wireless, two rooftop-mounted fixed WDOLS are required to be installed at the base in order to provide adequate coverage of the bus depot.

2.1.1 Fixed WDOLS 1 – Building 2 – Bus Wash

The fixed WDOLS will be installed in the southeast corner of the building next to the entrance to the bus wash. The antenna will be installed on the roof in the southeast corner. Figure 1 shows the intended position of the AP antenna on the roof of the building. The 180-degree antenna will provide strong coverage from the northern side of the base facing south, allowing the signal to propagate over the entire bus yard.

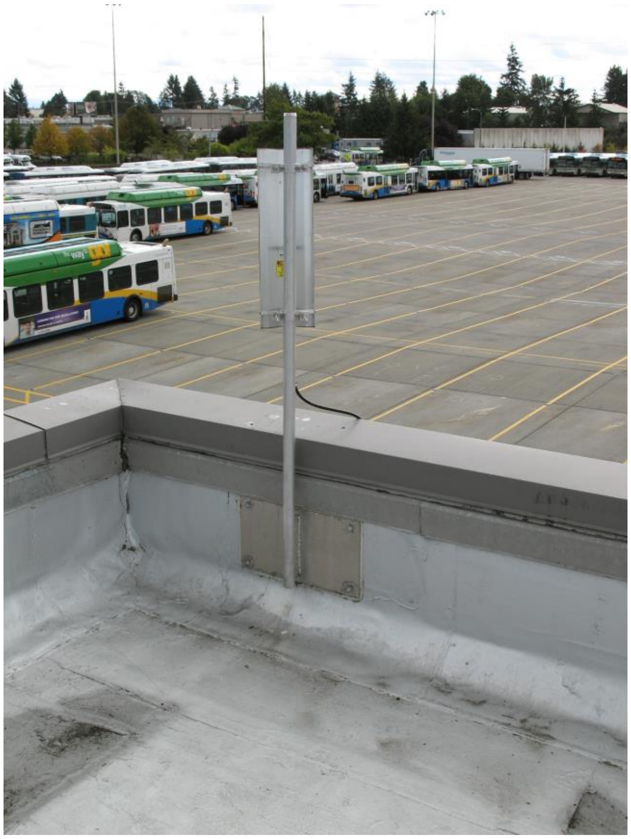


Figure 1: Position of Antenna Mount

2.1.1.1 Antenna Installation

This installation will use a bracket that will bolt to the concrete surface as shown in Figure 1. This type of antenna mount will secure the antenna to the concrete wall and will be very rigid. The antenna will be mounted to this mast and will be adjusted for the correct down tilt and angle by ERG.

Responsibilities for the work that will take place on the rooftop, as agreed by ERG and PT are:

- ERG will supply the antenna bracket to PT.
- PT will install the antenna bracket to the concrete wall with 4 x ½-inch anchors, each of length at least three inches.
- PT will make a hole in the side of the building (as shown in Figure 2) for the antenna cable to enter the building.
- ERG will install the antenna and antenna cable.

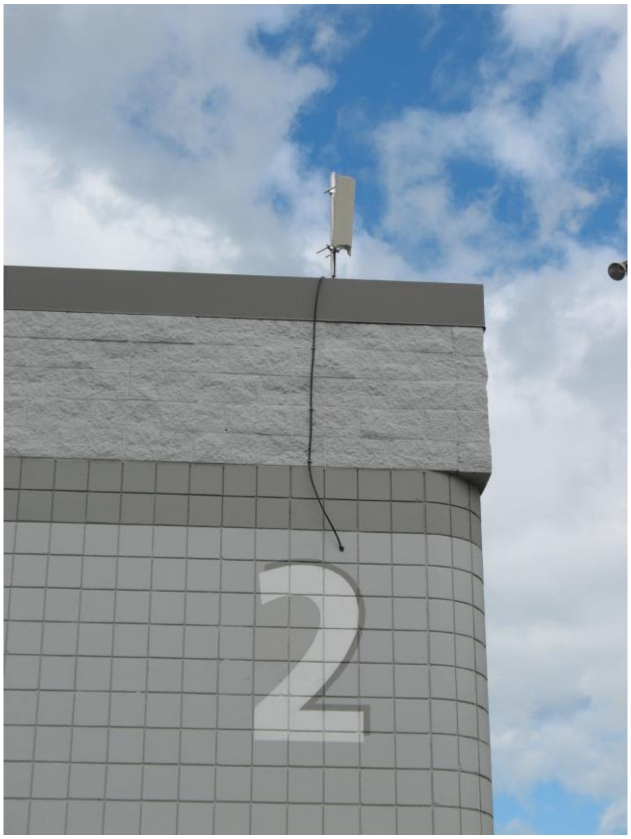


Figure 2: Position of Hole in Side of Building for Antenna Cable

2.1.1.2 AP Installation

The Cisco 1242 AP will be mounted in a National Electrical Manufacturers Association (NEMA) box inside the bus wash area on the south facing wall. The NEMA box should be mounted within 12 to 14 inches of the antenna cable hole in the wall. The box can be mounted either side of the hole, and the bottom of the box should be at the same approximate level as the hole.

The NEMA box that will be installed at PT has the following specifications:

- Model number BLine 20168-4XFTPW, 4X rating
- Dimensions: height 19.69 inches, width 16.75 inches, depth 8.07 inches
- Weight of approximately 10 lbs.

ERG recommends using 4 x 3/8-inch anchors of at least two-inch length to anchor the box to the wall.

The antenna cable will run through the hole in the wall through the bottom of the NEMA box. The cable will then be connected to the Cisco 1242 AP.

Two Ethernet cables are run from the AP back to the network connection point in the building. These cables will be run in PVC conduit for protection.

Responsibilities for the work that will take place inside the building, as agreed by ERG and PT are:

- ERG will supply the NEMA 4X box to PT with the AP bracket already installed in the box.
- PT will install the NEMA box within 12 to 14 inches of the antenna cable hole, with the bottom at the same level as the cable hole.
- PT will install two Ethernet cables from the NEMA box back to the equipment room to make the network connection. PT will determine the route of these cables. These cables must be plenum rated. PT will supply one Ethernet cable; ERG will supply the other Ethernet cable.
- PT will supply and install PVC conduit for Ethernet cabling.
- ERG will mount the AP to the bracket and make the cable connections.

2.1.1.3 Power Injector Installation

The Cisco 1242 Power Injector will be mounted in the equipment room where the network connection is made.

Responsibilities for the work that will take place inside the equipment room, as agreed by ERG and PT are:

- PT will provide the 110VAC power outlet for the Power Injector power supply to plug into.
- ERG will supply and install the Power Injector and connect the Ethernet cable previously run by PT.
- ERG will supply and install the patch cable from the Power Injector to the network switch connection.

2.1.2 Fixed WDOLS 2 – Building 4 – Administration Building

The fixed WDOLS will be installed on west corner of the building. Figure 3 shows the intended position of the AP antenna on the side of the building. The 120-degree antenna will provide strong coverage from the east side of the base facing west, allowing the signal to propagate over the entire bus yard.

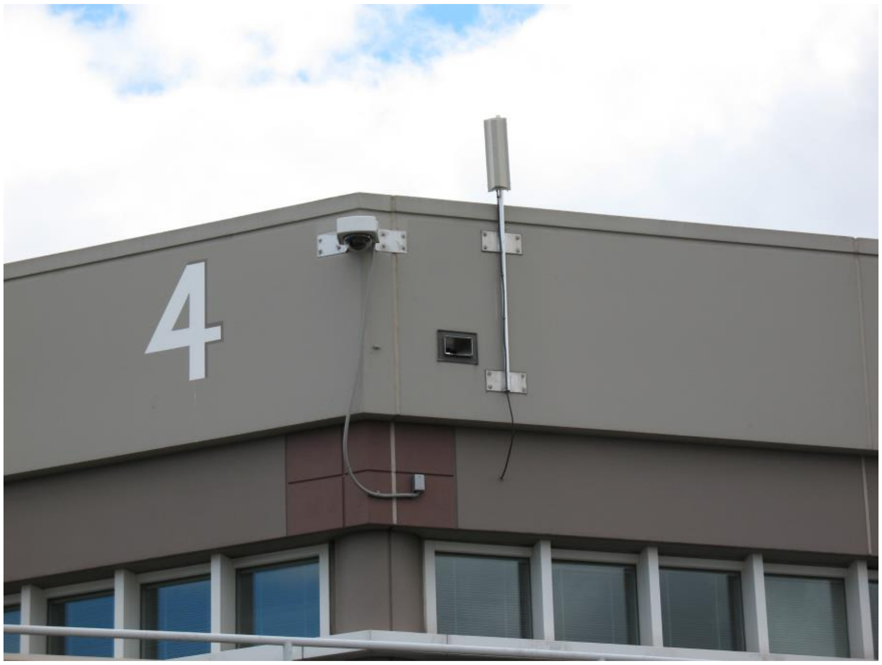


Figure 3: Position of Antenna Mount and Roof Cable Entry Point

2.1.2.1 Antenna Installation

This installation will use a mount that will bolt to the side wall surface (Figure 3) and will sit on the roof. The antenna will be mounted to this mast and will be adjusted for the correct down tilt and angle by ERG.

Responsibilities for the work that will take place on the rooftop, as agreed by ERG and PT are:

- ERG will supply the antenna bracket to PT.
- PT will install the antenna bracket to the wall with anchors chosen by PT that suit the thin veneer-like surface.
- PT will make the hole in the side of the building (as shown in Figure 3) for the antenna cable to enter the building.
- ERG will install the antenna and antenna cable.

2.1.2.2 AP Installation

The Cisco 1242 AP will be mounted in the ceiling above the office directly underneath the antenna mount. A tile will be removed from the suspended ceiling just underneath the roof; the AP should be mounted as close as practical to where the antenna cable enters the building through the hole. There are many places where the AP bracket can be mounted, and this should be finalized at the time of installation after the antenna cable hole has been made in the side of the building.

Responsibilities for the work that will take place inside the building, as agreed by ERG and PT are:

- PT will mount the AP bracket provided by ERG.
- PT will install two Ethernet cables from the AP position back to the equipment room to make the network connection. PT will determine the route of these cables. These cables must be plenum rated. PT will supply one Ethernet cable; ERG will supply the other Ethernet cable.
- ERG will mount the AP to the bracket and make the cable connections.

2.1.2.3 Power Injector Installation

The Cisco 1242 Power Injector will be mounted in the equipment room where the network connection is made.

Responsibilities for the work that will take place inside the equipment room, as agreed by ERG and PT are:

- PT will provide the 110VAC power outlet for the Power Injector power supply to plug into.
- ERG will supply and install the Power Injector and connect the Ethernet cable previously run by PT.
- ERG will supply and install the patch cable from the Power Injector to the network switch connection.

2.1.3 Fixed WDOLS 3 – Equipment room

A third Cisco 1242 AP must be installed in the equipment room that holds the Data Acquisition Computer (DAC). This AP will be mounted to the wall or it can sit in the equipment cabinet, whichever is preferred by PT.

Responsibilities for the work that will take place inside the equipment room as agreed by ERG and PT are:

- PT will provide the 110VAC power outlet for the AP power supply to plug into.
- ERG will supply and install the Cisco 1242 AP.
- ERG will supply and install the patch cable to connect the AP to the network.

3 Phase 2 Fixed WDOLS Installations

3.1 PT Main Base Installation Instructions

Based on the site survey conducted by ERG, one additional fixed WDOLS should be installed at the PT Main Base in order to provide adequate coverage of and data throughput at the bus depot

3.1.1 Fixed WDOLS 4 – Building 1 – Maintenance Building

The fixed WDOLS will be installed in the southeast corner of the building near Bay 12S. The antenna will be installed on the roof in the southeast corner. Figure 4 shows the intended position of the AP antenna on the roof of the building. The 90-degree antenna will provide coverage of the base facing southeast.

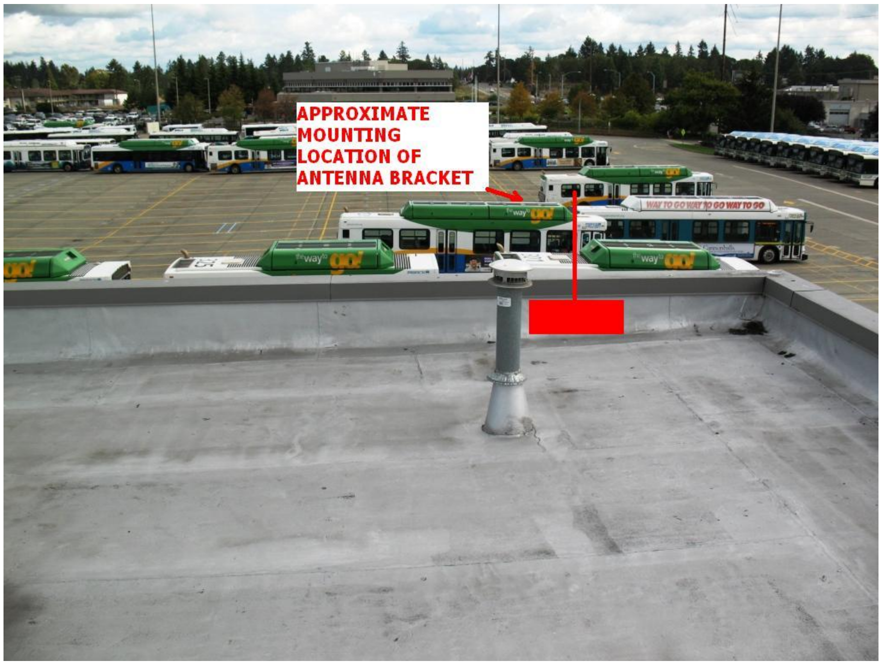


Figure 4: Position of Antenna Mount

3.1.1.1 Antenna Installation

This installation will use a bracket that will bolt to the concrete surface as shown in Figure 4. This type of antenna mount will secure the antenna to the concrete wall and will be very rigid. The antenna will be mounted to this mast and will be adjusted for the correct down tilt and angle by ERG.

Responsibilities for the work that will take place on the rooftop, as agreed by ERG and PT are:

- ERG will supply the antenna bracket to PT.
- PT will install the antenna bracket to the concrete wall with 4 x ½-inch anchors, each of length at least three inches.
- PT will make the hole in the side of the building (as shown in Figure 2) for the antenna cable to enter the building.
- ERG will install the antenna and antenna cable.

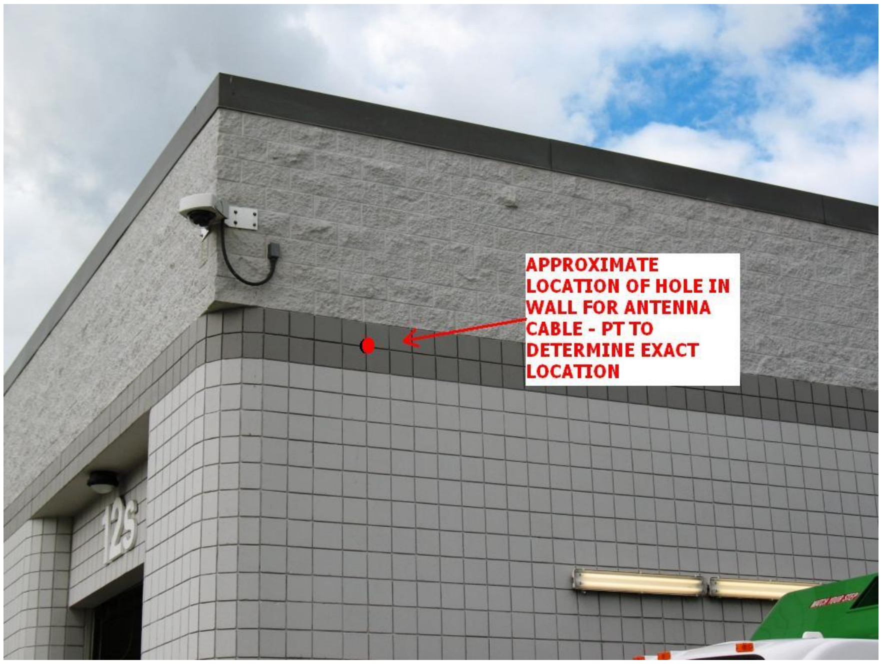

APPROXIMATE LOCATION OF HOLE IN WALL FOR ANTENNA CABLE - PT TO DETERMINE EXACT LOCATION
125

Figure 5: Position of Hole in Side of Building for Antenna Cable

3.1.1.2 AP Installation

The Cisco 1242 AP will be mounted to the concrete wall inside the building. Figure 6 shows the approximate location that the AP bracket will be mounted to the concrete wall. The exact location will be determined by the entry point of the antenna cable through the concrete wall.

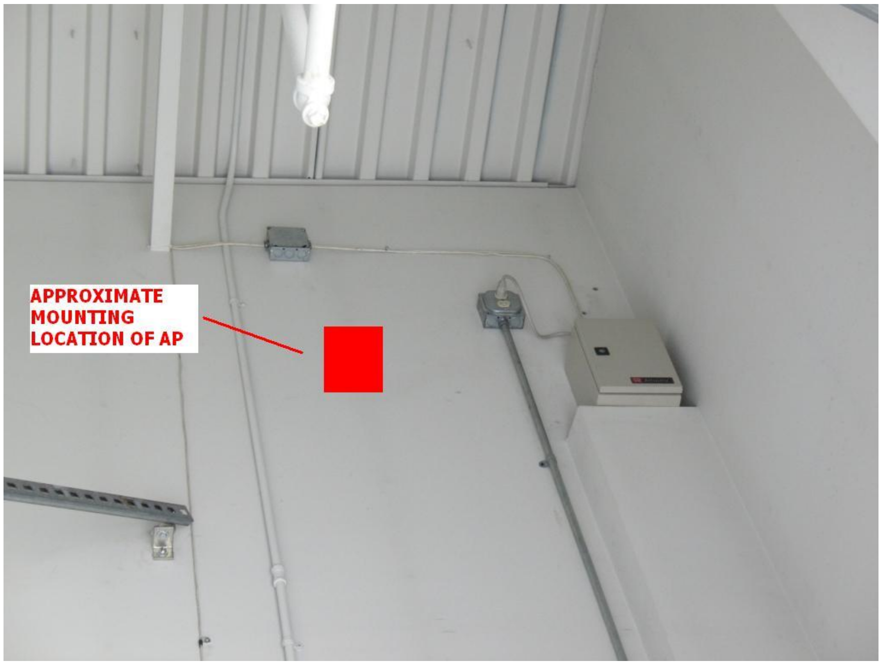


Figure 6: Location of AP

The Ethernet cable is run from the AP back to the network connection point in the building.

Responsibilities for the work that will take place inside the building, as agreed by ERG and PT are:

- PT will install the Ethernet cable from the AP location back to the equipment room to make the network connection. PT will determine the route of these cables. These cables must be plenum rated. PT will supply the Ethernet cable.
- ERG will mount the AP bracket and the AP and make the cable connections.

3.1.1.3 Power Injector Installation

The Cisco 1242 Power Injector will be mounted in the communications box where the network connection is made.

Responsibilities for the work that will take place inside the equipment room, as agreed by ERG and PT are:

- PT will provide the 110VAC power outlet for the Power Injector power supply to plug into.
- ERG will supply and install the Power Injector and connect the Ethernet cable previously run by PT.
- ERG will supply and install the patch cable from the Power Injector to the network switch connection.

3.2 Installation Guidelines to Remember

- The Ethernet cable used must be plenum rated!
- The antenna cable has a diameter of 5/8 inch, and has a minimum bend radius of 1.5 inches. This cable has quite a good minimum bend radius rating, but should be considered for installation.
- The maximum length the antenna cable can be is 20 feet. This should be considered when mounting the AP bracket in relation to the intended position of the mounted antenna.
- The AP bracket should be secured by at least two screws. The AP weighs approximately two pounds.

4 Fixed WDOLS Installations Post FSA

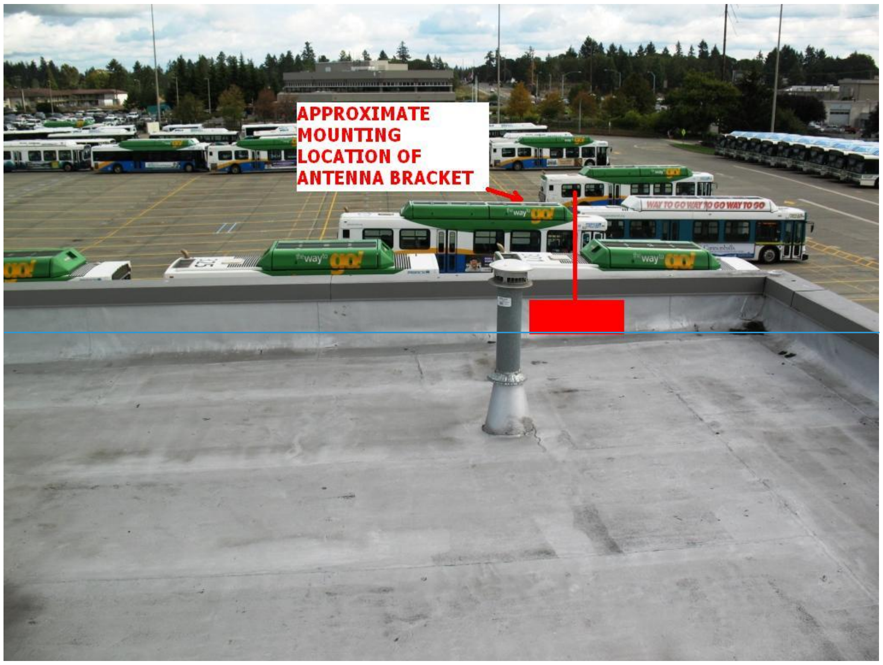
Commented [jb1]: All changes to this section are due to CR-002624 PT WDOLS Installation

4.1 PT Main Base Installation Instructions

Based on the site survey conducted by ERG, one additional fixed WDOLS may be installed at the PT Main Base to provide adequate coverage of the area behind the Maintenance building and to include portions of the King County facility to the west of the PT Maintenance area.

4.1.1 Fixed WDOLS ~~4~~ 5 – Building 1 – Maintenance Building

The fixed WDOLS will be installed in the ~~southeast~~ center ~~corner~~ of the west side of the building ~~near~~ between Bays ~~12S~~10W and 11W. The antenna will be installed on the roof ~~in~~ on the ~~southeast corne~~ west side~~r~~. ~~Figure 4~~ Figure 7 shows the intended position of the AP antenna on the roof of the building. The ~~90~~180-degree antenna will provide coverage of the ~~base facing southeast~~stalls to the rear of the Maintenance building and extending to the Pierce County facility to the west and below the Maintenance building.


APPROXIMATE MOUNTING LOCATION OF ANTENNA BRACKET

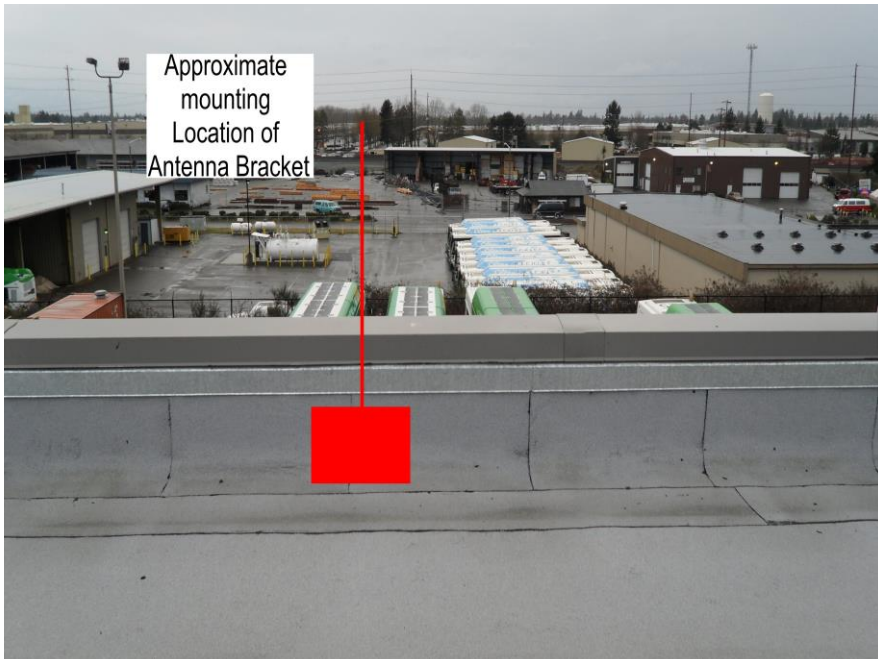


Figure 7: Position of Antenna Mount

~~**Figure 4: Position of Antenna Mount**~~

4.1.1.1 Antenna Installation

This installation will use a bracket that will bolt to the concrete surface similar to the one shown in Figure 8~~ Figure 48~~. This type of antenna mount will secure the antenna to the concrete wall and will be very rigid. The antenna will be mounted to this mast and will be adjusted for the correct down tilt and angle by ERG.

Responsibilities for the work that will take place on the rooftop, as agreed by ERG and PT are:

- ERG will supply the antenna bracket to PT.
- PT will install the antenna bracket to the concrete wall with 4 x ½-inch anchors, each of length at least three inches.
- PT will make the hole in the side of the building (as shown in Figure 2~~11~~) for the antenna cable to enter the building.
- ~~ERG~~ PT will install the ~~antenna and~~ antenna cable.
- ERG will install the antenna.

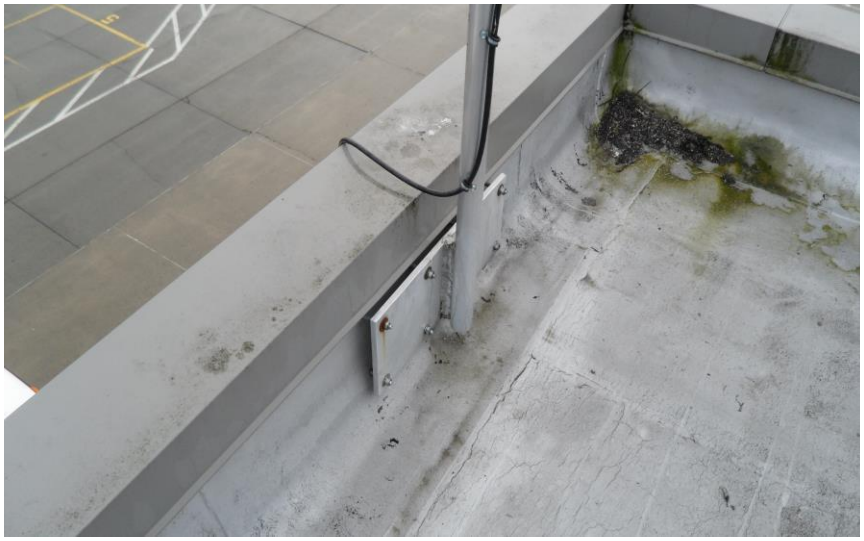
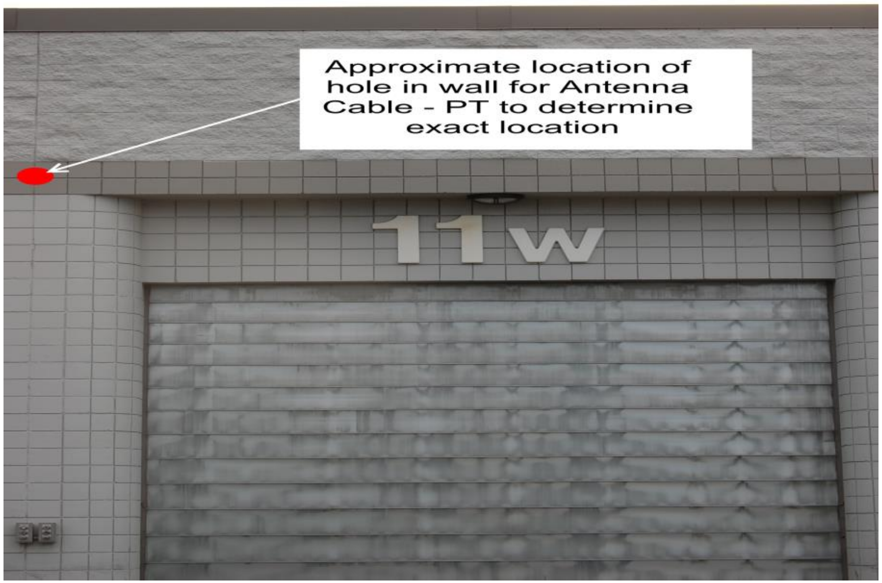


Figure 8: Antenna Mount



Approximate location of hole in wall for Antenna Cable - PT to determine exact location
11w

Figure 9: Position of hole inside of building for Antenna Cable

4.1.1.2 AP Installation

The Cisco 1242 AP will be mounted to the concrete wall inside the building. Figure 10 shows the approximate location that the AP bracket will be mounted to the concrete wall. The exact location will be determined by the entry point of the antenna cable through the concrete wall.

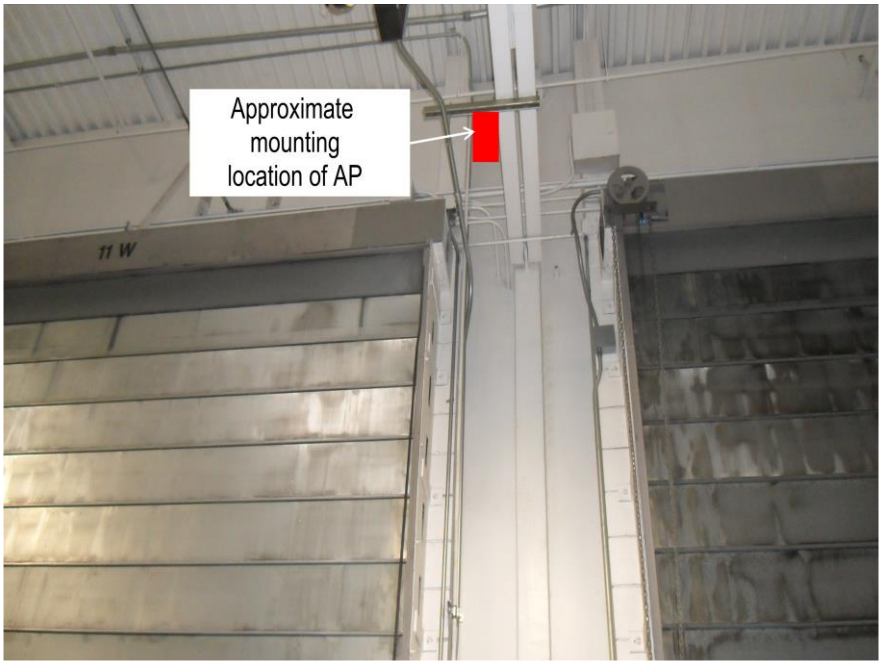


Figure 10: Location of AP

Two Ethernet cables are run from the AP back to the network connection point in the building.

Responsibilities for the work that will take place inside the building, as agreed by ERG and PT are:

- PT will install the Two Ethernet cables from the AP location back to the equipment room to make the network connection. PT will determine the route of these cables. These cables must be plenum rated. PT will supply the Ethernet cable.
- ERG will mount the AP bracket and the AP and make the cable connections.

~~4.1.1.3Power Injector Installation~~

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~~The Cisco 1242 Power Injector will be mounted to the concrete wall inside the building.~~

~~Responsibilities for the work that will take place inside the equipment room, as agreed by ERG and PT are:~~

- PT will provide the 110VAC power outlet ~~for the Power Injector power supply to~~that the AP will plug into directly.~~.~~

~~5.1.1~~4.1.2 Fixed WDOLS ~~4~~ 6 – Building 5 – ~~Maintenance Building~~Training Center

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The fixed WDOLS will be installed above the ceiling tiles near the center concrete façade on the south side of Bldg. 5, the antenna will be installed on the center concrete facade ~~in~~ on the ~~southeast corne~~ south side of the building~~r~~. Figure 11~~Figure 4 11~~ shows the intended position of the AP antenna on the roof of the building. The ~~90~~180-degree antenna will provide coverage of the ~~base facing southeast~~area to the rear of the Marketing/Training Facility.

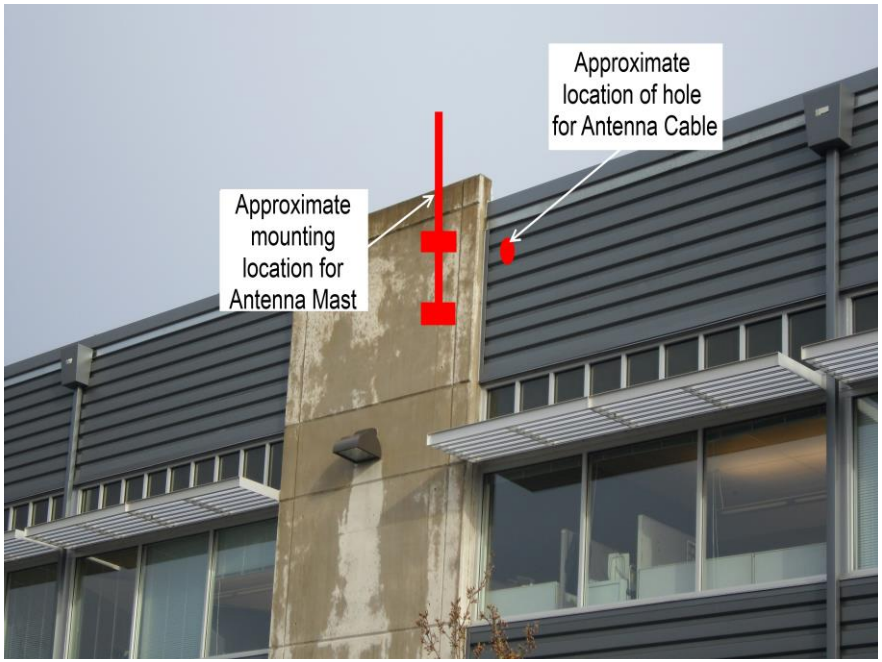
Approximate location of hole for Antenna Cable
Approximate mounting location for Antenna Mast

Figure 11: Position of Antenna Mount and hole for Antenna Cable

4.1.2.1 Antenna Installation

This installation will use a bracket that will bolt to the concrete surface similar to the one shown in Figure 3. This type of antenna mount will secure the antenna to the concrete wall and will be very rigid. The antenna will be mounted to this mast and will be adjusted for the correct down tilt and angle by ERG.

Responsibilities for the work that will take place on the rooftop, as agreed by ERG and PT are:

- ERG will supply the antenna bracket to PT.
- PT will install the antenna bracket to the concrete wall with ~~4 x ½-inch~~ anchors chosen by PT that suit the installation~~, each of length at least three inches~~.~~.~~
- PT will make ~~the~~a hole in the side of the building (as shown in ~~Figure 11~~Figure 11) for the antenna cable to enter the building.
- PT will install the antenna cable.
- ERG will install the antenna.

4.1.2.2 AP Installation

The Cisco 1242 AP will be mounted above the ceiling tiles in the Marketing area. Figure 12 shows the approximate location that the AP bracket will be mounted. The exact location will be determined by the entry point of the antenna cable through the concrete wall.

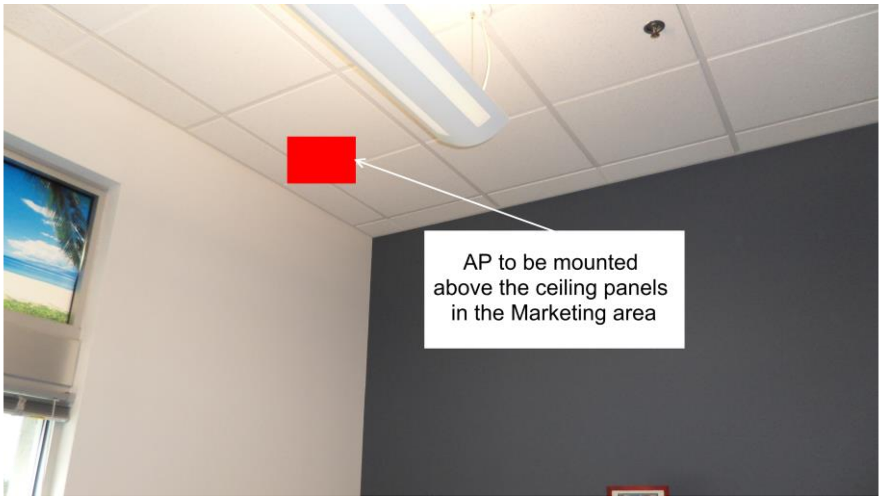
AP to be mounted above the ceiling panels in the Marketing area

Figure 12: Location of AP

Two Ethernet cables are run from the AP back to the network connection point in the building.

Responsibilities for the work that will take place inside the building, as agreed by ERG and PT are:

- PT will install the two Ethernet cables from the AP location back to the equipment room Figure 13 to make the network connection. PT will determine the route of these cables. These cables must be plenum rated. PT will supply the Ethernet cable.
- ERG will mount the AP bracket and the AP and make the cable connections.

4.1.2.3 Power Injector Installation

The Cisco 1242 Power Injector will be mounted to the wall inside the building.

Responsibilities for the work that will take place inside the equipment room, as agreed by ERG and PT are:

- PT will provide the 110VAC power outlet for the Power Injector power supply to plug into.
- ERG will supply and install the Power Injector and connect the Ethernet cable previously run by PT.
- ERG will supply and install the patch cable from the Power Injector to the network switch connection.

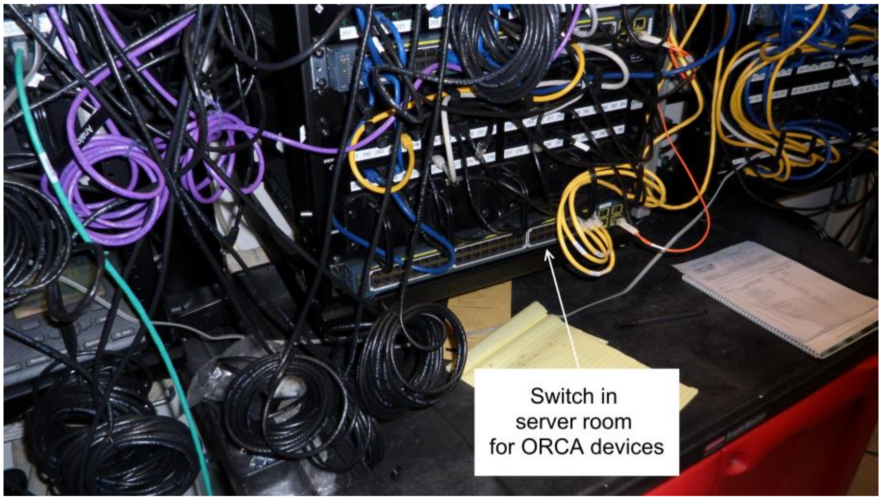

Figure 13: Ethernet Connection in Bldg. 5 Server Room

4.2 Installation Guidelines to Remember

- The Ethernet cable used must be plenum rated!
- The antenna cable has a diameter of 5/8 inch, and has a minimum bend radius of 1.5 inches. This cable has quite a good minimum bend radius rating, but should be considered for installation.
- The maximum length the antenna cable can be is 20 feet. This should be considered when mounting the AP bracket in relation to the intended position of the mounted antenna.
- The AP bracket should be secured by at least two screws. The AP weighs approximately two pounds.